NI 6356/6358 Specifications

Français Deutsch 日本語 한국어 简体中文

ni.com/manuals

Specifications listed below are typical at 25 °C unless otherwise noted. Refer to the *X Series User Manual* for more information about NI PXIe-6356/6358 and NI USB-6356 (32 MS and 64 MS) devices.

Analog Input

Number of channels
- NI 6356 ..... 8 differential
- NI 6358 ..... 16 differential

ADC resolution ..... 16 bits

DNL ..... No missing codes guaranteed

INL ..... Refer to the *AI Absolute Accuracy Table*

Sampling rate
- Maximum ..... 1.25 MS/s per channel
- Minimum ..... No minimum
- Timing accuracy ..... 50 ppm of sample rate
- Timing resolution ..... 10 ns

Input coupling ..... DC

Input range ..... ±10 V, ±5 V, ±2 V, ±1 V

Maximum working voltage for all analog inputs
- Positive input (AI+) ..... ±11 V for all ranges, Measurement Category I
- Negative input (AI–) ..... ±11 V for all ranges, Measurement Category I

Caution Do *not* use for measurements within Categories II, III, and IV.

CMRR (at 60 Hz) ..... 75 dB

Bandwidth ..... 1 MHz

THD ..... –80 dBFS

Input impedance
- Device on
  - AI– to AI GND ..... >100 GΩ in parallel with 10 pF
  - AI+ to AI GND ..... >100 GΩ in parallel with 10 pF
- Device off
  - AI+ to AI GND ..... 2 kΩ
  - AI– to AI GND ..... 2 kΩ

Input bias current ..... ±10 pA

Crosstalk (at 100 kHz)
- Adjacent channels ..... –80 dB
- Non-adjacent channels ..... –100 dB

Input FIFO size
- NI PXIe-6356/6358 ..... 8,182 samples shared among channels used
- NI USB-6356 (32 MS) ..... 32 MS shared among channels used
- NI USB-6356 (64 MS) ..... 64 MS shared among channels used

Data transfers
- NI PXIe-6356/6358 ..... DMA (scatter-gather), programmed I/O
- NI USB-6356 ..... USB Signal Stream, programmed I/O

Overvoltage protection (AI+, AI–)
- Device on ..... ±36 V
- Device off ..... ±15 V

Input current during overvoltage conditions ..... ±20 mA max/AI pin

Analog Triggers

Number of triggers 1

Source
- NI 6356 ..... AI <0..7>, APFI 0
- NI 6358 ..... AI <0..15>, APFI <0, 1>

Functions ..... Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase

Source level
- AI <0..15> ..... ±full scale
- APFI <0, 1> ..... ±10 V

Resolution ..... 16 bits

Modes ..... Analog edge triggering, analog edge triggering with hysteresis, and analog window triggering

Bandwidth (–3 dB)
- AI <0..15> ..... 3.4 MHz
- APFI <0, 1> ..... 3.9 MHz

Accuracy ..... ±1% of range

APFI <0, 1> characteristics
- Input impedance ..... 10 kΩ
- Coupling ..... DC
- Protection
  - Power on ..... ±30 V
  - Power off ..... ±15 V

Analog Output

Number of channels
- NI 6356 2
- NI 6358 4

DAC resolution ..... 16 bits

DNL ..... ±1 LSB max

Monotonicity ..... 16 bit guaranteed

Accuracy ..... Refer to the *AO Absolute Accuracy Table*

Update rate
- Maximum
  - One channel ..... 3.3 MS/s
  - Two channels ..... 3.3 MS/s
  - Three channels ..... 3.3 MS/s
  - Four channels ..... 3.3 MS/s
- Minimum ..... No minimum

Timing accuracy ..... 50 ppm of sample rate

Timing resolution ..... 10 ns

Output range ..... ±10 V, ±5 V, ±external reference on APFI <0, 1>

Output coupling ..... DC

Output impedance ..... 0.4 Ω

Output current drive ..... ±5 mA

Overdrive protection ..... ±25 V

Overdrive current ..... 10 mA

Power-on state ..... ±5 mV

Power-on/off glitch
- NI PXIe-6356/6358 ..... 1.5 V peak for 200 ms
- NI USB-6356 ..... 1.5 V peak for 200 ms[1]

Output FIFO size ..... 8,191 samples shared among channels used

Data transfers
- NI PXIe-6356/6358 ..... DMA (scatter-gather), programmed I/O
- NI USB-6356 ..... USB Signal Stream, programmed I/O

[1] Typical behavior. Time period may be longer due to host system USB performance. Time period will be longer during firmware updates.

AO waveform modes:

- Non-periodic waveform
- Periodic waveform regeneration mode from onboard FIFO
- Periodic waveform regeneration from host buffer including dynamic update

Settling time, full-scale step
15 ppm (1 LSB) ..... 2 µs

Slew rate ..... 20 V/µs

Glitch energy at midscale transition
±10 V range ..... 6 nV · s

External Reference

APFI <0, 1> characteristics

Input impedance ..... 10 kΩ

Coupling ..... DC

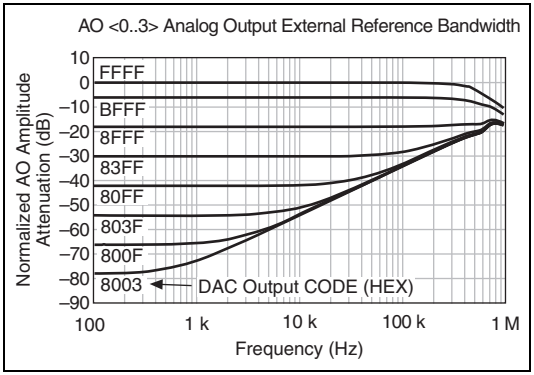
Protection

Power on ..... ±30 V

Power off..... ±15 V

Range ..... ±11 V

Slew rate ..... 20 V/µs



Calibration (AI and AO)

Recommended warm-up time..... 15 minutes

Calibration interval ..... 1 year

AI Absolute Accuracy Table

Nominal Range		Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/°C)	Reference Tempco (ppm/°C)	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)	Random Noise, σ (μVrms)	Absolute Accuracy at Full Scale[1] (μV)
Positive Full Scale	Negative Full Scale								
10	–10	95	8	5	15	35	46	252	2498
5	–5	102	8	5	15	36	46	134	1289
2	–2	102	8	5	15	42	46	71	528
1	–1	120	8	5	15	50	46	61	291

AbsoluteAccuracy = Reading · (GainError) + Range · (OffsetError) + NoiseUncertainty

GainError = ResidualAIGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)

OffsetError = ResidualAIOffsetError + OffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

$$\text{NoiseUncertainty} = \frac{\text{RandomNoise} \cdot 3}{\sqrt{10{,}000}}$$ For a coverage factor of 3 σ and averaging 10,000 points

[1] Absolute accuracy at full scale on the analog input channels is determined using the following assumptions:

TempChangeFromLastExternalCal = 10 °C

TempChangeFromLastInternalCal = 1 °C

number_of_readings = 10,000

CoverageFactor = 3 σ

For example, on the 10 V range, the absolute accuracy at full scale is as follows:

GainError = 95 ppm + 8 ppm · 1 + 5 ppm · 10 GainError = 153 ppm

OffsetError = 15 ppm + 35 ppm · 1 + 46 ppm OffsetError = 96 ppm

$$\text{NoiseUncertainty} = \frac{252\ \mu\text{V} \cdot 3}{\sqrt{10{,}000}}$$ NoiseUncertainty = 7.6 μV

AbsoluteAccuracy = 10 V · (GainError) + 10 V · (OffsetError) + NoiseUncertainty AbsoluteAccuracy = 2,498 μV

Accuracies listed are valid for up to one year from the device external calibration.

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AO Absolute Accuracy Table

Nominal Range		Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/°C)	Reference Tempco (ppm/°C)	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)	Absolute Accuracy at Full Scale[1] (μV)
Positive Full Scale	Negative Full Scale							
10	–10	110	17	5	65	1	64	3,066
5	–5	117	8	5	65	1	64	1,526

[1] Absolute Accuracy at full scale numbers is valid immediately following internal calibration and assumes the device is operating within 10 °C of the last external calibration. Accuracies listed are valid for up to one year from the device external calibration.

AbsoluteAccuracy = OutputValue · (GainError) + Range · (OffsetError)
GainError = ResidualGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)
OffsetError = ResidualOffsetError + AOOffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

Digital I/O/PFI

Static Characteristics

Number of channels
- NI 6356 ..... 24 total, 8 (P0.<0..7>), 16 (PFI <0..7>/P1, PFI <8..15>/P2)
- NI 6358 ..... 48 total, 32 (P0.<0..31>), 16 (PFI <0..7>/P1, PFI <8..15>/P2)

Ground reference ..... D GND

Direction control ..... Each terminal individually programmable as input or output

Pull-down resistor ..... 50 kΩ typ, 20 kΩ min

Input voltage protection[1] ..... ±20 V on up to two pins

Waveform Characteristics (Port 0 Only)

Terminals used
- NI 6356 ..... Port 0 (P0.<0..7>)
- NI 6358 ..... Port 0 (P0.<0..31>)

Port/sample size
- NI 6356 ..... Up to 8 bits
- NI 6358 ..... Up to 32 bits

Waveform generation (DO) FIFO .... 2,047 samples

Waveform acquisition (DI) FIFO .... 255 samples

DI Sample Clock frequency
- NI PXIe-6356/6358 ..... 0 to 10 MHz, system and bus activity dependent
- NI USB-6356 ..... 0 to 1 MHz system and bus activity dependent

DO Sample Clock frequency
- NI PXIe-6356/6358
  - Regenerate from FIFO ..... 0 to 10 MHz
  - Streaming from memory ..... 0 to 10 MHz, system and bus activity dependent
- NI USB-6356
  - Regenerate from FIFO ..... 0 to 10 MHz
  - Streaming from memory ..... 0 to 1 MHz system and bus activity dependent

Data transfers
- NI PXIe-6356/6358 ..... DMA (scatter-gather), programmed I/O
- NI USB-6356 ..... USB Signal Stream, programmed I/O

Digital line filter settings ..... 160 ns, 10.24 µs, 5.12 ms, disable

PFI/Port 1/Port 2 Functionality

Functionality ..... Static digital input, static digital output, timing input, timing output

Timing output sources ..... Many AI, AO, counter, DI, DO timing signals

Debounce filter settings ..... 90 ns, 5.12 µs, 2.56 ms, custom interval, disable; programmable high and low transitions; selectable per input

Recommended Operation Conditions

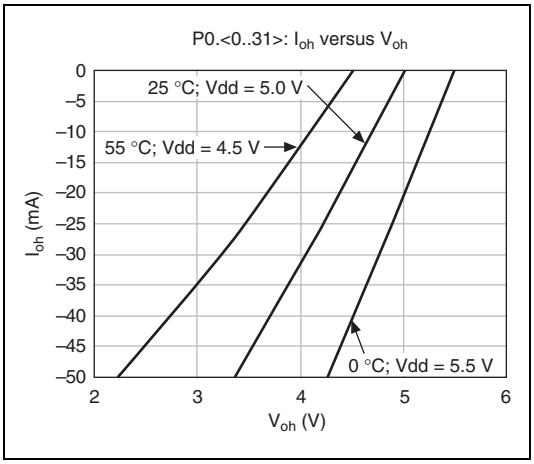
Level	Min	Max
Input high voltage (V_{IH})	2.2 V	5.25 V
Input low voltage (V_{IL})	0 V	0.8 V
Output high current (I_{OH})		
P0.<0..7>	—	–24 mA
PFI <0..15>/P1/P2	—	–16 mA
Output low current (I_{OL})		
P0.<0..7>	—	24 mA
PFI <0..15>/P1/P2	—	16 mA

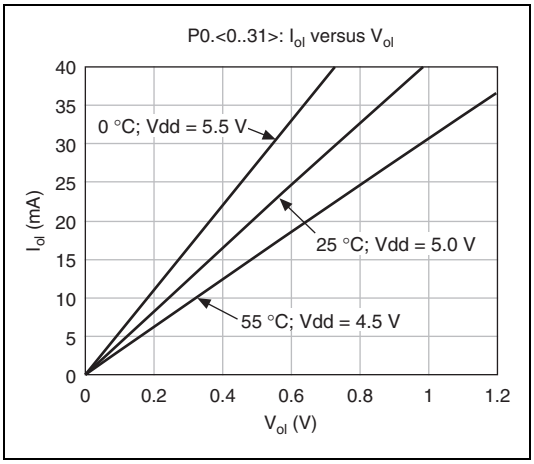
Electrical Characteristics

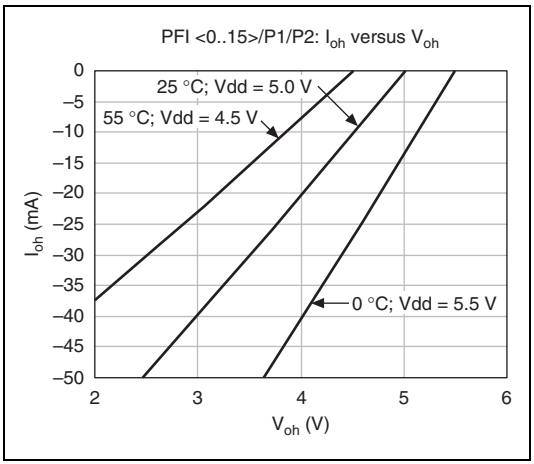
Level	Min	Max
Positive-going threshold (VT+)	—	2.2 V
Negative-going threshold (VT–)	0.8 V	—
Delta VT hysteresis (VT+ – VT–)	0.2 V	—
I_{IL} input low current (V_{in} = 0 V)	—	–10 µA
I_{IH} input high current (V_{in} = 5 V)	—	250 µA

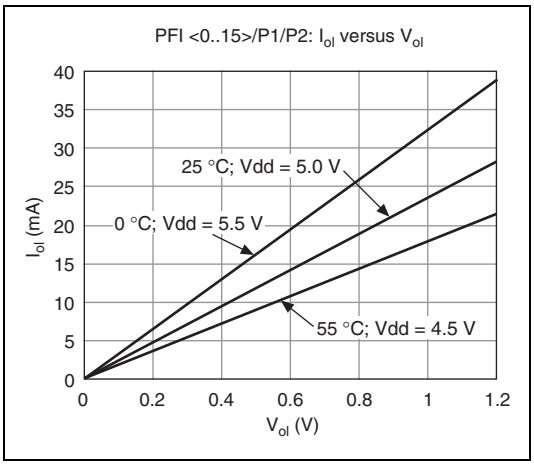
[1] Stresses beyond those listed under *Input voltage protection* may cause permanent damage to the device.

Digital I/O Characteristics









General-Purpose Counter/Timers

Number of counter/timers 4

Resolution.....32 bits

Counter measurements .....Edge counting, pulse, pulse width, semi-period, period, two-edge separation

Position measurements .....X1, X2, X4 quadrature encoding with Channel Z reloading; two-pulse encoding

Output applications.....Pulse, pulse train with dynamic updates, frequency division, equivalent time sampling

Internal base clocks .....100 MHz, 20 MHz, 100 kHz

External base clock frequency

- NI PXIe-6356/6358.....0 MHz to 25 MHz; 0 MHz to 100 MHz on PXIe-DSTAR<A, B>
- NI USB-6356 .....0 MHz to 25 MHz

Base clock accuracy .....50 ppm

Inputs .....Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down, Sample Clock

Routing options for inputs

- NI PXIe-6356/6358.....Any PFI, PXIe-DSTAR<A, B>, PXI_TRIG, PXI_STAR, analog trigger, many internal signals
- NI USB-6356 .....Any PFI, analog trigger, many internal signals

FIFO .....127 samples per counter

Data transfers

- NI PXIe-6356/6358.....Dedicated scatter-gather DMA controller for each counter/timer, programmed I/O
- NI USB-6356 .....USB Signal Stream, programmed I/O

Frequency Generator

Number of channels 1

Base clocks ..... 20 MHz, 10 MHz, 100 kHz

Divisors..... 1 to 16

Base clock accuracy..... 50 ppm

Output can be available on any PFI terminal.

Phase-Locked Loop (PLL)

Number of PLLs 1

Reference clock locking frequencies

Reference Signal	Locking Input Frequency (MHz)	
	PXIe	USB
PXIe_DSTAR<A, B>	10, 20, 100	—
PXI_STAR	10, 20	—
PXIe_CLK100	100	—
PXI_TRIG <0..7>	10, 20	—
PFI <0..15>	10, 20	10

Output of PLL..... 100 MHz Timebase; other signals derived from 100 MHz Timebase including 20 MHz and 100 kHz Timebases

External Digital Triggers

Source

- NI PXIe-6356/6358 ..... Any PFI, PXIe-DSTAR<A, B>, PXI_TRIG, PXI_STAR
- NI USB-6356..... Any PFI

Polarity..... Software-selectable for most signals

Analog input function ..... Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase

Analog output function ..... Start Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase

Counter/timer functions ..... Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down, Sample Clock

Digital waveform generation (DO) function..... Start Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase

Digital waveform acquisition (DI) function ..... Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase

Device-To-Device Trigger Bus

Input source

- NI PXIe-6356/6358 ..... PXI_TRIG <0..7>, PXI_STAR, PXIe-DSTAR<A, B>
- NI USB-6356..... None

Output destination

- NI PXIe-6356/6358 ..... PXI_TRIG <0..7>, PXIe-DSTARC
- NI USB-6356..... None

Output selections..... 10 MHz Clock; frequency generator output; many internal signals

Debounce filter settings ..... 90 ns, 5.12 µs, 2.56 ms, custom interval, disable; programmable high and low transitions; selectable per input

Bus Interface

NI PXIe-6356/6358

- Form factor ..... x1 PXI Express peripheral module, specification rev 1.0 compliant
- Slot compatibility ..... x1 and x4 PXI Express or PXI Express hybrid slots
- DMA channels ..... 8, analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1, counter/timer 2, counter/timer 3

All NI PXIe-6356/6358 devices may be installed in PXI Express slots or PXI Express hybrid slots.

NI USB-6356

- USB compatibility ..... USB 2.0 Hi-Speed or full-speed[1]
- USB Signal Stream ..... 8, can be used for analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1, counter/timer 2, counter/timer 3

Power Requirements

NI PXIe-6356

- +3.3 V ..... 4.7 W
- +12 V ..... 15.4 W

NI PXIe-6358

- +3.3 V ..... 7.8 W
- +12 V ..... 22.2 W

Caution NI USB-6356 devices *must* be powered with NI offered AC adapter or a National Electric Code (NEC) Class 2 DC source that meets the power requirements for the device and has appropriate safety certification marks for country of use.

NI USB-6356

- Power supply requirements..... 11 to 30 VDC, 30 W, 2 positions 3.5mm pitch pluggable screw terminal with screw locks similar to Phoenix Contact MC 1,5/2-STF-3,5 BK
- Power input mating connector .... Phoenix Contact MC 1,5/2-GF-3,5 BK or equivalent

[1] Operating on a full-speed bus will result in lower performance and you might not be able to achieve maximum sampling/update rates.

Current Limits

Caution Exceeding the current limits may cause unpredictable behavior by the device and/or chassis.

NI PXIe-6356

+5 V terminal (connector 0).....1 A max[1]

NI PXIe-6358

+5 V terminal (connector 0).....1 A max[1]

+5 V terminal (connector 1).....1 A max[1]

P0/PFI/P1/P2 and +5 V terminals combined.....1.8 A max

NI USB-6356

+5 V terminal.....1 A max[1]

Physical Requirements

Printed circuit board dimensions
NI PXIe-6356/6358.....Standard 3U PXI

Enclosure dimensions (includes connectors)
NI USB-6356.....26.4 × 17.3 × 3.6 cm (10.4 × 6.8 × 1.4 in.)

Weight

NI PXIe-6356.....168 g (5.9 oz)

NI PXIe-6358.....241 g (8.5 oz)

NI USB-6356.....1.42 kg (3 lb 2 oz)

I/O connector

NI PXIe-6356.....1 68-pin VHDCI

NI PXIe-6358.....2 68-pin VHDCI

NI USB-6356.....64 screw terminals

NI PXIe-6356/6358 mating connectors:

- 68-Pos Right Angle Single Stack PCB-Mount VHDCI (Receptacle), MOLEX 71430-0011
- 68-Pos Right Angle Dual Stack PCB-Mount VHDCI (Receptacle), MOLEX 74337-0016
- 68-Pos Offset IDC Cable Connector (Plug) (SHC68-*), MOLEX 71425-3001

NI USB-6356
screw terminal wiring.....16–24 AWG

Maximum Working Voltage[2]

Channel-to-earth.....11 V, Measurement Category I

Caution Do *not* use for measurements within Categories II, III, or IV.

Environmental

Operating temperature

NI PXIe-6356/6358.....0 to 55 °C

NI USB-6356.....0 to 45 °C

Storage temperature.....–40 to 70 °C

Humidity.....10 to 90% RH, noncondensing

Maximum altitude.....2,000 m

Pollution Degree (indoor use only).....2

Shock and Vibration (NI PXIe-6356/6358 Only)

Operational shock.....30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.)

Random vibration

Operating.....5 to 500 Hz, 0.3 g_{rms}

Nonoperating.....5 to 500 Hz, 2.4 g_{rms} (Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

[1] Has a self-resetting fuse that opens when current exceeds this specification.

[2] *Maximum working voltage* refers to the signal voltage plus the common-mode voltage.

Safety

This product meets the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Caution When operating this product, use shielded cables and accessories

Note For EMC declarations and certifications, refer to the *Online Product Certification* section.

CE Compliance CE

This product meets the essential requirements of applicable European Directives as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

To obtain product certifications and the Declaration of Conformity (DoC) for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at `ni.com/environment`. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit `ni.com/environment/weee`.

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中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 `ni.com/environment/rohs_china`。(For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)

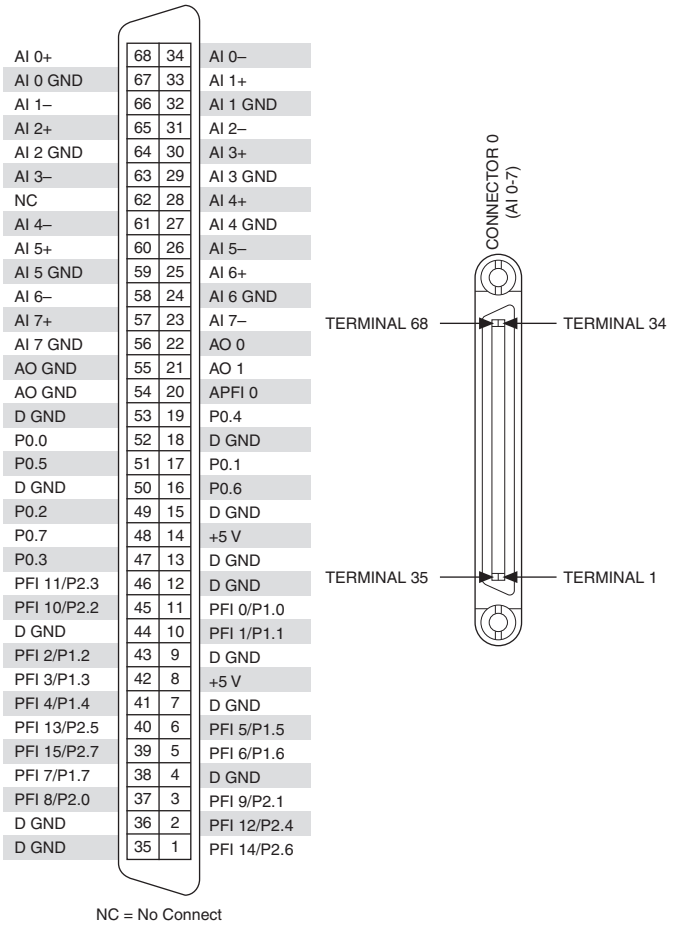
AI 0+ 68 34 AI 0–
AI 0 GND 67 33 AI 1+
AI 1– 66 32 AI 1 GND
AI 2+ 65 31 AI 2–
AI 2 GND 64 30 AI 3+
AI 3– 63 29 AI 3 GND
NC 62 28 AI 4+
AI 4– 61 27 AI 4 GND
AI 5+ 60 26 AI 5–
AI 5 GND 59 25 AI 6+
AI 6– 58 24 AI 6 GND
AI 7+ 57 23 AI 7–
AI 7 GND 56 22 AO 0
AO GND 55 21 AO 1
AO GND 54 20 APFI 0
D GND 53 19 P0.4
P0.0 52 18 D GND
P0.5 51 17 P0.1
D GND 50 16 P0.6
P0.2 49 15 D GND
P0.7 48 14 +5 V
P0.3 47 13 D GND
PFI 11/P2.3 46 12 D GND
PFI 10/P2.2 45 11 PFI 0/P1.0
D GND 44 10 PFI 1/P1.1
PFI 2/P1.2 43 9 D GND
PFI 3/P1.3 42 8 +5 V
PFI 4/P1.4 41 7 D GND
PFI 13/P2.5 40 6 PFI 5/P1.5
PFI 15/P2.7 39 5 PFI 6/P1.6
PFI 7/P1.7 38 4 D GND
PFI 8/P2.0 37 3 PFI 9/P2.1
D GND 36 2 PFI 12/P2.4
D GND 35 1 PFI 14/P2.6
NC = No Connect
CONNECTOR 0
(AI 0-7)
TERMINAL 68
TERMINAL 34
TERMINAL 35
TERMINAL 1

Figure 1. NI PXIe-6356 Pinout

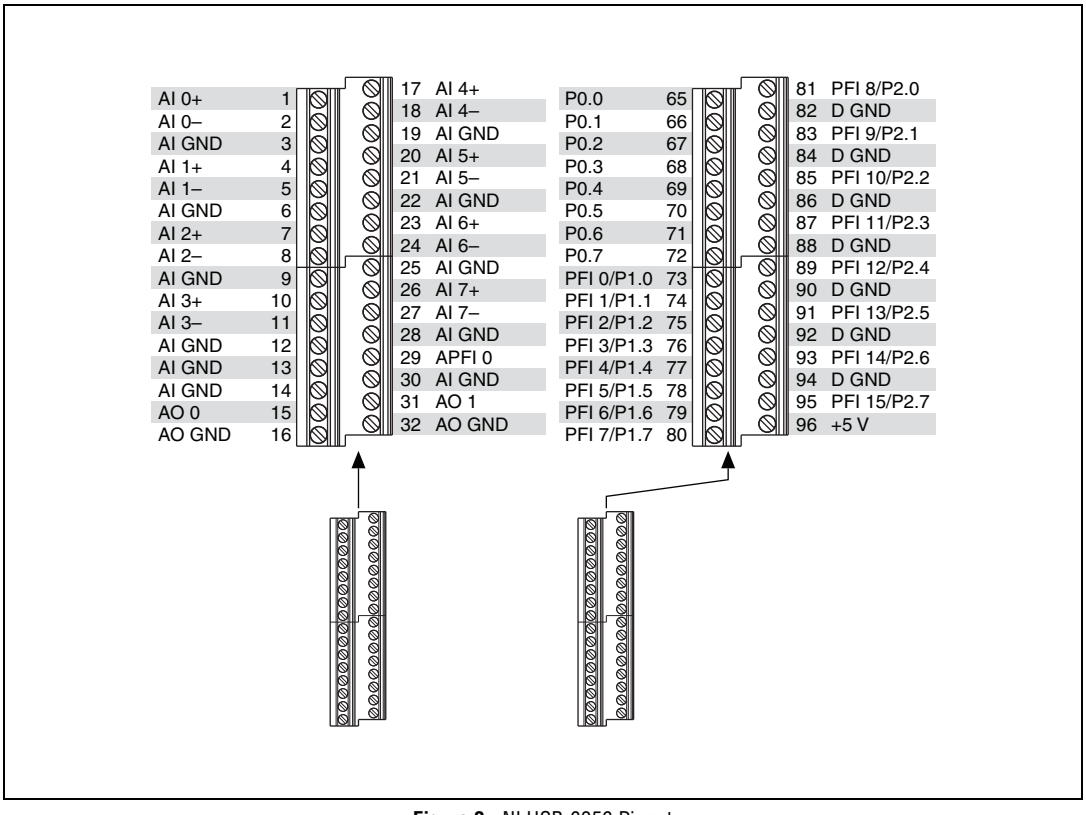

Figure 2. NI USB-6356 Pinout

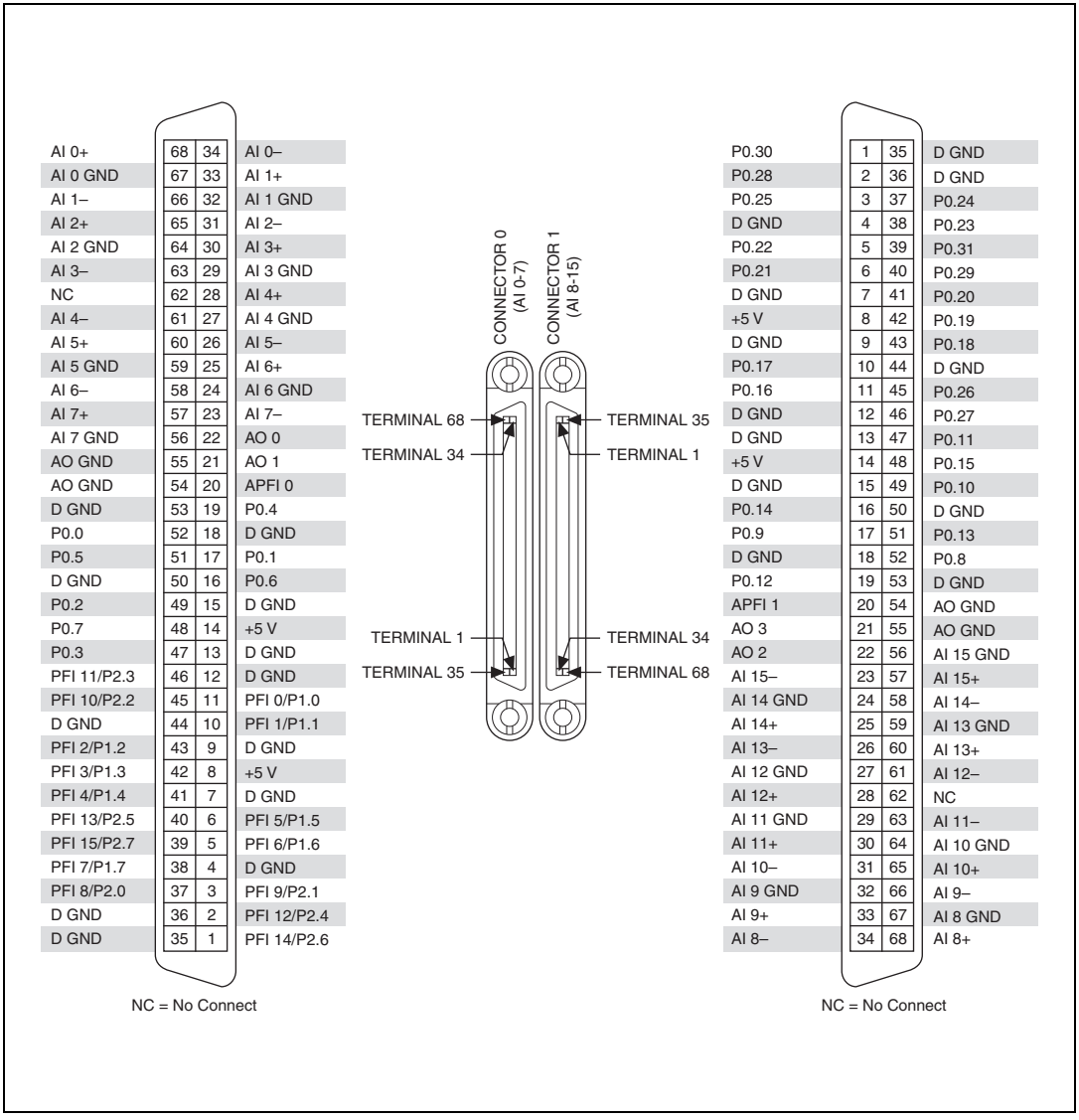

Figure 3. NI PXIe-6358 Pinout

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